

CYTOTAXONOMIC NOTES ON
THE SPECIES OF *CIRSIUM* NATIVE
TO THE SOUTHEASTERN UNITED STATES

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All of the southern thistles are classified under the subgenus *Eucirsium*, section *Onotrophe* of Petrak (1917). Following a modified version of Petrak's classification, the chromosomal relationships of the southern species may be summarized as follows:

Subgenus EUCIRSIUM, Section ONOTROPHE

Subsect. ODORATA: $2n = 30, 32, 34, (33, 35)$. *C. pumilum*, *C. repandum*, *C. lecontei*, *C. horridulum*, *C. vittatum*.

Subsect. CAMPANULATA: $2n = 24, (26)$. *C. nuttallii*

Subsect. ACANTHOPHYLLA:

Series ALTISSIMA (including series Mutica):

$2n = 18, 20, (21, 22, 23, 30, 31)$. *C. altissimum*, *C. terrae-nigrae*, *C. discolor*, *C. muticum*, *C. carolinianum*.

Series PANICULATA: $2n = 22, (23, 24)$. *C. texanum*.

Series UNDULATA: $2n = 26, (22-34)$. *C. undulatum*.

Series VIRGINIANA: $2n = 28$. *C. virginianum*.

We know of no prior published records of chromosome counts for the following species: *C. repandum* Michx., *C. lecontei* T. & G., *C. vittatum* Small, *C. nuttallii* DC., *C. terrae-nigrae* Shinnery, *C. carolinianum* (Walt.) Fern. & Schub., *C. texanum* Buckl. and *C. virginianum* (L.) Michx.

Much of the material used in these studies was obtained from plants brought in from the wild and subsequently grown in the greenhouse over a period of several months. The remainder came from seedlings obtained from seeds, also from the wild, some of which were grown to maturity.

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Root tips were obtained and subsequently handled as described by Ownbey & Hsi (1963) and by Ownbey (1968). Preparations for observations of meiotic stages were made according to procedures described by Ownbey, l.c. Voucher specimens for nearly all of the chromosomal records have been deposited in the herbarium of the University of Minnesota.

Sect. ONOTROPHE, Subsect. ODORATA

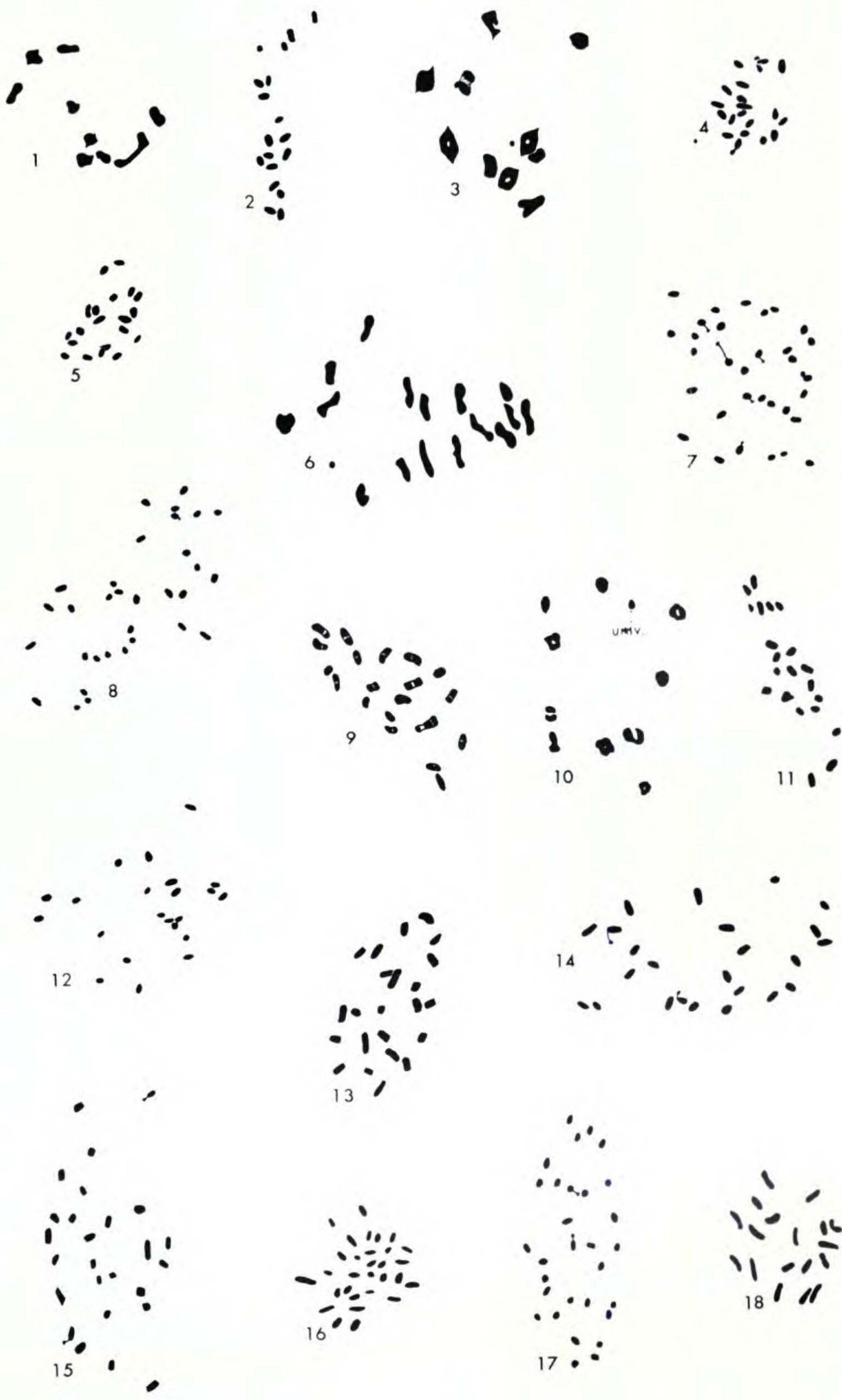
The *Odorata* as circumscribed here includes three species groups of equivalent taxonomic rank. The first group is formed of *C. pumilum* and *C. repandum*, the second of *C. lecontei* and the third of *C. horridulum* and *C. vittatum*. We have transferred *C. repandum* and *C. lecontei* from Petrak's subsect. *Campanulata* of the sect. *Onotrophe* as we believe this reflects their actual genetic relationships.

1. ***Cirsium pumilum* (Nutt.) Spreng. subsp. *pumilum*.**
 $2n = 30$

NORTH CAROLINA. CHATHAM CO.: Route 64, 4 miles east of the Chatham County courthouse, Pittsboro, *Olson & Ownbey* 836, (2 plants).

Chromosomal information for this species is consistent with that from earlier reports by Ownbey & Hsi (1963) and Frankton & Moore (1966) based upon specimens from Connecticut, Massachusetts and New York. Our specimens

Figs. 1-18. Chromosomes of *Cirsium* drawn with camera lucida, all $\times 1000$. Fig. 1. *C. altissimum*, O. & O. 802, $n = 9$. Fig. 2. *C. altissimum*, O. & O. 802, $2n = 18$. Fig. 3. *C. carolinianum*, O. & O. 797, $n = 10$. Fig. 4. *C. carolinianum*, O. & O. 797, $2n = 20$. Fig. 5. *C. discolor*, O. & O. 837, $2n = 20$. Fig. 6. *C. horridulum*, O., O. & Thieret 798, $n = 16$. Fig. 7. *C. horridulum*, O., O. & Thieret 798, $2n = 32$. Fig. 8. *C. lecontei*, O. & O. 807, $2n = 32$. Fig. 9. *C. muticum*, O., O. & Thieret 799, pl. 1, $2n = 20$. Fig. 10. *C. muticum*, O., O. & Thieret 799, pl. 6, $n = 10 \text{ II} + 1 \text{ I}$. Fig. 11. *C. muticum*, O., O. & Thieret 799, pl. 6, $2n = 21$. Fig. 12. *C. muticum*, O., O. & Thieret 799, pl. 6, $2n = 22$. Fig. 13. *C. muticum*, O., O. & Thieret 799, pl. 3, $2n = 23$. Fig. 14. *C. nuttallii*, O. & O. 810, $2n = 24$. Fig. 15. *C. nuttallii*, O. & O. 825, $2n = 26$. Fig. 16. *C. pumilum*, O. & O. 836, $2n = 30$. Fig. 17. *C. repandum*, O. & O. 828, $2n = 30$. Fig. 18. *C. terrae-nigrae*, O. & O. 791, $2n = 18$.



from North Carolina indicate that the sporophytic number of 30 is constant for the species throughout its range. One or two additional chromosomes may be present in hybrids of *C. pumilum* with plants of *C. horridulum* having a sporophytic number of 32, as demonstrated by Moore & Frankton, l.c. Hybrids may appear spontaneously where the two species occur together.

2. *Cirsium repandum* Michx. $2n = 30$

NORTH CAROLINA. WAYNE CO.: 7 miles southeast of Goldsboro turnoff, Route 70, *Olson & Ownbey* 835, (2 plants).

SOUTH CAROLINA. BERKELEY CO.: 7.3 miles northeast of Summer-ville, Route 17A, *Olson & Ownbey* 828, (1 plant); 7.8 miles northeast of McClellanville Post Office, Route 17, *Olson & Ownbey* 831, (1 plant).

Although our data for this species are minimal, the sporophytic chromosome number is probably 30 throughout its range. It is closely related to *C. pumilum*, having the same chromosome number and similar morphological features.

3. *Cirsium lecontei* T. & G. $2n = 32$

FLORIDA. WALTON CO.: 1.0 mile west of Santa Rosa Beach, Route 98, *Olson & Ownbey* 807, (1 plant).

MISSISSIPPI. HANCOCK CO.: 7.2 miles west of Waveland, Route 43 (1 mile west of junction of routes 90 and 43), *Olson & Ownbey* 804, (1 plant).

Our limited chromosomal data indicate that this species belongs in the subsect. *Odorata*. It is a distinctive species of wetland habitats and in this regard differs from other members of the subsection.

4. *Cirsium horridulum* Michx. $2n = 32$ (33, 34)

FLORIDA. FRANKLIN CO.: 1 mile west of Apalachicola, *Olson & Ownbey* 808, $2n = 32$ (1 plant), 33, 34 (1 plant).

GEORGIA. GLYNN CO.: just north of Brunswick along Route 17, *Olson & Ownbey* 824, (1 plant).

LOUISIANA. BATON ROUGE PARISH: just south of Port Allen, *Ownbey* 3621, (3 plants). LAFAYETTE PARISH: northern environs of Lafayette, *Olson, Ownbey & Thieret* 798, $n = 16$, (1 plant), $2n = 32$ (3 plants).

MISSISSIPPI. FORREST CO.: 3.2 miles north of Maxie, Route 49, *Olson & Ownbey* 806, (1 plant).

NORTH CAROLINA. ONSLOW CO.: 7.6 miles north of Folkstone, *Olson & Ownbey* 834, (3 plants).

TEXAS. HARDIN CO.: just north of Silsbee, *Ownbey* 3623, (2 plants). PANOLA-RUSK CO. line: 8.4 miles northeast of Mt. Enterprise (9.9 miles southwest of Clayton), *Ownbey* 3625, (2 plants).

This species had a chromosome number of $2n = 32$ in all collections examined during this study with a single exception from Franklin Co., Florida where the number was 33 or 34 in one plant. Lewis, Stripling & Ross (1962) reported counts of $2n = 34$ for two collections, one from Franklin Co., and one from Leon Co., Florida. Moore & Frankton (1966) report $2n = 34$ in one collection of this species from Massachusetts. They also report hybridization of this species with *C. pumilum* in Massachusetts.

Cirsium horridulum is very closely related to *C. vittatum* and it is often difficult to distinguish them, especially as to herbarium specimens. In the field, *C. horridulum* appears to be a larger and coarser plant with predominantly ochroleucous flowers which appear earlier in the spring. Populations which we classified as *C. vittatum* consisted of more slender, branched plants with lavender flowers appearing later in the spring. *C. horridulum* is found from eastern Texas to New England in the coastal and adjacent states; *C. vittatum* is of more restricted distribution in Florida and the coastal areas of the southeastern states.

Natural hybridization between *C. horridulum* and *C. vittatum* is to be expected and, in fact, the difficulties of separating the two may be due to this factor. Extensive analysis of this species complex is much needed.

5. *Cirsium vittatum* Small. $2n = 32, 34 (33, 35)$

FLORIDA. CITRUS CO.: 1.6 miles south of Crystal River, Route 19, *Olson & Ownbey* 812, $2n = 32$ (2 plants), 33 (1 plant). CLAY CO.: ca. 1.2 miles south of the junction of routes 218 and 21 (on 218) near Middleburg, *Olson & Ownbey* 823, $n = 16 + 1$ (1 plant), $2n = 33$ (1 plant), 35 (1 plant). COLLIER CO.: just west of Paolita Sta., Route 41, *Olson & Ownbey* 814, $2n = 32$ (1 plant), 34 (2 plants), 35 (1 plant). DADE CO.: just south of Florida City, *Olson & Ownbey* 815, $2n = 32$ (3 plants), 34 (2 plants); about 1 mile southeast of Kendall, east of Route 1, *Olson & Ownbey* 816, $2n = 32$ (1 plant). VOLUSIA CO.: 7.6 miles southeast of Pierson (2 miles southeast of Barberville), *Olson & Ownbey* 819, $2n = 32$ (1 plant), 33 (2 plants), 34 (1 plant),

34, 35 (1 plant). WAKULLA CO.: 1 mile west of Newport, Route 98, *Olson & Ownbey* 809, $2n = 32$ (3 plants).

SOUTH CAROLINA. GEORGETOWN CO.: southwestern outskirts of Andrews, Route 41, *Olson & Ownbey* 829, $2n = 32$ (4 plants). DORCHESTER CO.: northern environs of Summerville, *Olson & Ownbey* 827, $n = 16$ (1 plant), $2n = 32$ (2 plants).

This species is characterized by variation in the sporophytic chromosome number even within a single population. Normally, the number appears to be 32 or 34, but accessory chromosomes which are morphologically indistinguishable from those of the regular complement are sometimes present. In one instance the chromosome number in cells of a single root tip was not constant, being either 34 or 35.

The differences between *C. vittatum* and *C. smallii* Britt. are inconsequential and we do not attempt to distinguish them. When combined, the older name, *C. vittatum*, must be adopted for the resulting taxon. For comments regarding the distinctions between *C. vittatum* and *C. horridulum*, see the latter species.

Subsect. CAMPANULATA

6. *Cirsium nuttallii* DC. $2n = 24$ (26)

FLORIDA. HERNANDO CO.: 12.8 miles south of Homosassa Springs, Route 19, *Olson & Ownbey* 813, (4 plants). LEVY CO.: 1 mile southeast of Chiefland, *Olson & Ownbey* 811, (4 plants). OKEECHOBEE CO.: 1 mile south of Okeechobee, Route 441, *Olson & Ownbey* 817, (4 plants). PUTNAM CO.: 1.7 miles north of Palatka, Route 17, *Olson & Ownbey* 820, (4 plants). TAYLOR CO.: 1 mile southeast of Salem, *Olson & Ownbey* 810, (2 plants).

GEORGIA. GLYNN CO.: ca. 10 miles north of Brunswick, *Olson & Ownbey* 825, $2n = 24$ (2 plants), 26 (1 plant).

SOUTH CAROLINA. HAMPTON CO.: 0.5 mile south of Hampton-Colleton Co. line, *Olson & Ownbey* 826, (3 plants).

With the exception of a single plant with $2n = 26$, the chromosomal data for this species is very consistent. The species has no close relatives among the southern thistles.

Subsect. ACANTHOPHYLLA, Series ALTISSIMA

We believe that Petrak's series *Mutica* of the *Acanthophylla* should be combined with the series *Altissima* in order to more clearly portray the close chromosomal and morphological relationships of this group of species.

7. **Cirsium altissimum** (L.) Spreng. $2n = 18$

MISSISSIPPI. ADAMS CO.: between Washington and Natchez, *Olson & Ownbey* 802, $n = 9$ (2 plants), $2n = 18$ (3 plants).

OKLAHOMA. LE FLORE CO.: 15.2 miles southeast of Hodgen (5.0 miles southeast of junction of routes 59 and 259), *Ownbey* 3627, (1 plant).

TEXAS. CASS CO.: 1 mile south of Red Hill, Route 8, *Ownbey* 3626, (2 plants).

The sporophytic chromosome number of 18 for the three collections reported here is consistent with earlier counts by Frankton & Moore (1963) and Ownbey & Hsi (1963). The only deviation from this figure was $2n = 20$ reported in one Iowa collection by Ownbey & Hsi, l.c. All earlier counts came from plants from the northern part of the range of the species. The present counts are from the southern and southwestern periphery of the range. Plants from the Mississippi population were taller and with more deeply lobed cauline leaves than is usual in this species.

8. **Cirsium terrae-nigrae** Shinnars (*C. filipendulum* Engelm., not Lange). $2n = 18$

TEXAS. ELLIS CO.: 2.0 miles southwest of Bardwell, *Olson & Ownbey* 793, (4 plants). KAUFMAN CO.: 1.4 miles northeast of Scurry, Route 34, *Olson & Ownbey* 791, (5 plants).

This species is closely related to *C. altissimum* with which it shares the same chromosome number, $2n = 18$, the lowest so far recorded for the genus *Cirsium*. Both species develop thickened, fusiform roots which are especially conspicuous during the rosette stage and tend to disappear during formation of the flowering stems.

9. **Cirsium discolor** (Muhl.) Spreng. $2n = 20$

NORTH CAROLINA. ALLEGHENY CO.: along Blue Ridge Parkway west of Cherry Lane, alt. ca. 3600 ft., *Olson & Ownbey* 837, $n = 10$ (1 plant), $2n = 20$ (1 plant).

Chromosomal data for this species has been recorded by Ownbey (1951), Frankton & Moore (1963) and Ownbey & Hsi (1963). The sporophytic number of 20 has been found to be constant except for one seedling studied by Frankton & Moore, grown from Virginia seed, which had 21. The present collection was made in North Carolina at the southeastern extremity of the species range.

10. **Cirsium muticum** Michx. $2n = 20$ (21, 22, 23)

LOUISIANA. LAFAYETTE PARISH: southwestern environs of Lafayette, Olson, Ownbey & Thieret 799, $n = 10$ (1 plant), $10 + 1$ (3 plants), $2n = 20$ (2 plants), 21 (2 plants), 20, 21, 22 (1 plant), 23 (1 plant).

Earlier reported counts for this species are as follows: Ownbey (1951) and Ownbey & Hsi (1963), $2n = 20$; Frankton & Moore (1963), $2n = 20, 22$. Frankton & Moore reported an apparent case of triploidy in Florida material. They studied five plants with $2n = 30$ and one plant, which exhibited some morphological peculiarities, with $2n = 31$. Preliminary studies of one plant indicated that 15 bodies, presumably bivalents, were regularly present at metaphase I. The additional chromosome in one plant was thought to be due to meiotic irregularity and not to be an accessory chromosome in the usual sense.

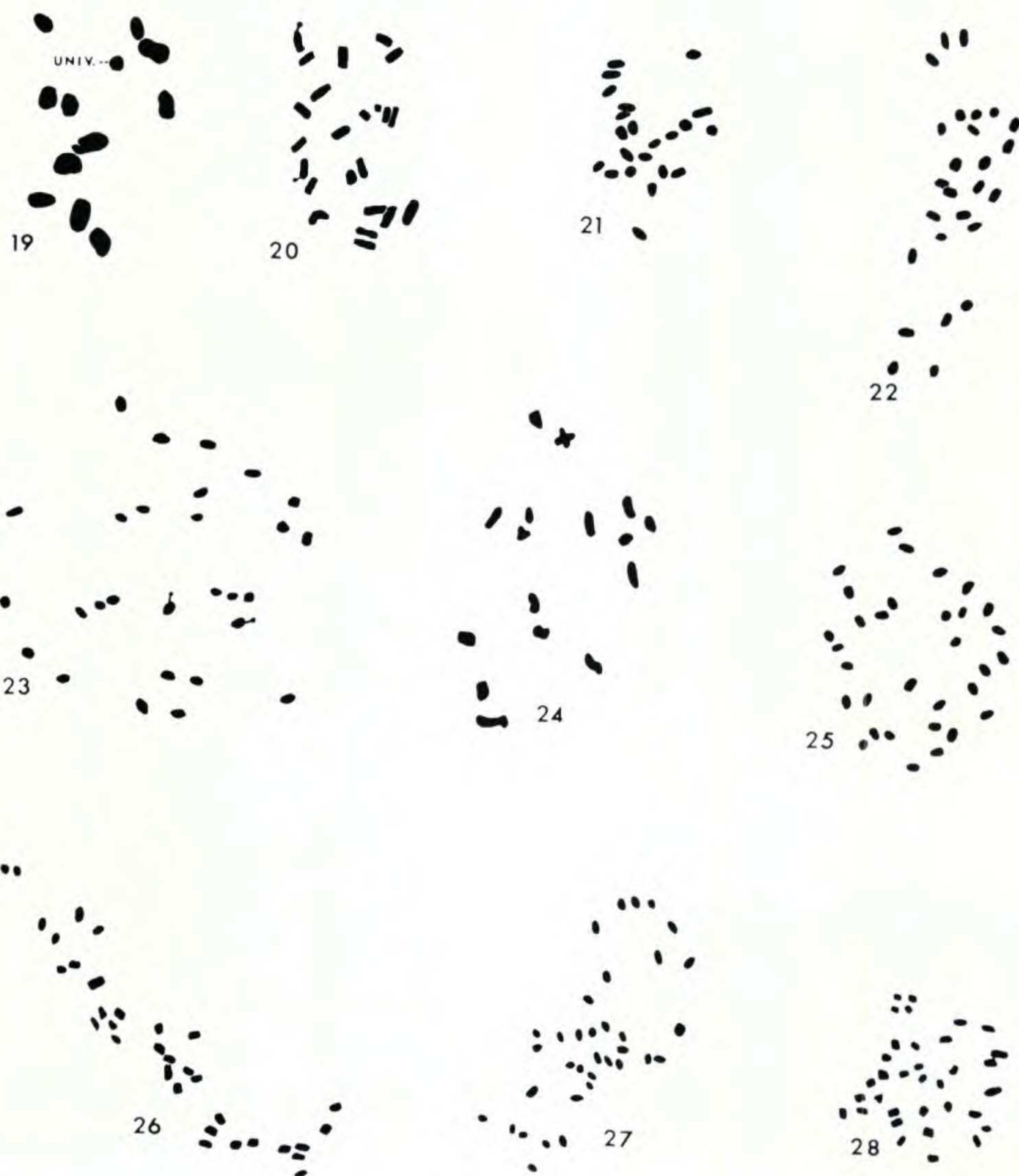
Considerable instability in chromosome numbers was seen in plants of Olson & Ownbey 799. Pollen mother cells at metaphase showed 10 normally paired bivalents in all plants, but in three plants there was an additional smaller, unpaired chromosome. Root tip cells had 20-23 chromosomes in individual plants. In one plant the root tips differed in their chromosomal complements, having 20, 21 or 22 chromosomes in individual cases. Presumably this could result from mitotic misdivisions of the accessory chromosome. *C. muticum* from Louisiana differs in many small ways from the species as we are accustomed to see it in the northern wetlands. A more detailed experimental study of the southern races of this species would be valuable.

11. **Cirsium carolinianum** (Walt.) Fern. & Schub.

$2n = 20$

TEXAS. POLK CO.: 0.1 mile east of junction of Texas farm roads 942 and 2500, on Route 942 east of Leggett, Olson & Ownbey 797, $n = 10$ (2 plants), $2n = 20$ (2 plants).

More chromosomal data for this species is needed, but the data now available indicate that the species is correctly placed in the series *Altissima*. The plants studied came from the southwestern edge of the species range.



Figs. 19-28. Chromosomes of *Cirsium* drawn with camera lucida, all $\times 1000$. Fig. 19. *C. texanum*, O. & O. 792, $n = 11 \text{ II} + 1 \text{ I}$. Fig. 20. *C. texanum*, O. & O. 792, $2n = 23$. Fig. 21. *C. texanum*, O. & O. 794, $2n = 22$. Fig. 22. *C. undulatum*, O. & O. 795, $2n = 26$. Fig. 23. *C. virginianum*, O. & O. 830, $2n = 28$. Fig. 24. *C. vittatum*, O. & O. 827, $n = 16$. Fig. 25. *C. vittatum*, O. & O. 815, $2n = 32$. Fig. 26. *C. vittatum*, O. & O. 812, $2n = 33$. Fig. 27. *C. vittatum*, O. & O. 814, pl. 4, $2n = 35$. Fig. 28. *C. vittatum*, O. & O. 814, pl. 2, $2n = 34$.

Series PANICULATA

12. *Cirsium texanum* Buckl. $2n = 22$ (23, 24)

TEXAS. BELL CO.: 3 miles south of Temple, Ownbey & Baker 2977, $2n = 22$ (1 plant); 4.6 miles south of Temple city limits on the road to Academy, Ownbey & Baker 2978, $2n = 22$ (2 plants). DALLAS CO.:

Route 114, 4 miles northwest of the crossing of the Elm Branch of the Trinity River, *Ownbey & Baker* 2972, $2n = 22$ (2 plants). ELLIS CO.: 1.1 miles southwest of Bardwell, *Olson & Ownbey* 792, $n = 11$ (2 plants), $11 + 1$ (1 plant), $2n = 22$ (1 plant), 23 (3 plants), 24 (1 plant). FALLS CO.: 2.0 miles east of Marlin, *Olson & Ownbey* 796, $n = 11$ (3 plants), $2n = 22$ (2 plants). HILL CO.: Lake Whitney State Park, *Olson & Ownbey* 794, $2n = 22$ (2 plants). MC CULLOCH CO.: 9 miles west of Brady city hall, Route 87, *Ownbey & Baker* 2988, $n = 11$ (2 plants), $2n = 22$ (2 plants). PECOS CO.: Tunis Spring, 20 miles east of Ft. Stockton, Route 290, *Ownbey & Baker* 3001, $2n = 24$ (1 plant). SAN PATRICIO CO.: ca. 2 miles southwest of Portland, *Jones s.n.*, $n = 11$ (2 plants), $2n = 22$ (2 plants); 7 miles south of Taft, *Jones s.n.*, $n = 11 + 1$ (2 plants), $2n = 23$ (2 plants). TOM GREEN CO.: Concho River crossing, 2.4 miles northeast of Tankersly, *Ownbey & Baker* 2996, $2n = 22$ (6 plants), 24 (1 plant).

Rather extensive sampling of this species indicates that the sporophytic chromosome number is normally 22, but sometimes is 23 or 24. No meiotic material of plants with $2n = 24$ was studied so it is unknown whether 11 or 12 bivalents are formed at metaphase I. In plants with $2n = 22$, 11 bivalents were seen at metaphase I; in plants with $2n = 23$, 11 bivalents plus 1 univalent were ordinarily present. *Jones s.n.*, from south of Taft, San Patricio Co., Texas, was seen to have 11 bivalents plus 1 univalent or 10 bivalents and 1 trivalent at metaphase I, indicating that the accessory chromosome in this collection is a homologue capable of undergoing normal pairing. Jones (personal communication) states that the two populations from San Patricio Co. were distinguishable in the field both on the basis of morphology and habitat. Possibly the extra chromosome in the one population produces a visible effect in this instance. *C. texanum* is, however, a variable species and there may actually be two distinguishable taxa lumped together under this binomial at the present time. The question is under study.

Although a very common thistle in its natural area, *C. texanum* is not found outside Texas and adjacent Mexico. *Ownbey & Baker* 2988 was collected near the type locality of the species. *Ownbey & Baker* 3001 was collected near the type locality of *Carduus austrinus* Small which, judging from a study of the type specimens of the two, is a synonym

of *Cirsium texanum*. *Carduus austrinus* is based upon Wright 1291 which, according to A. Gray (1853, p. 101), came from "Low and grassy flats around Escondido Springs, between the Pecos and the Limpio; June." Escondido Springs, according to Geiser (1935), is situated 19.5 miles east of Comanche Springs (now Fort Stockton). Petrak (1917, p. 419) erroneously lists *Carduus austrinus* Small as a synonym of *Cirsium ochrocentrum* Gray var. *helleri* (Small) Petrak.

Petrak, (l.c., p. 447 et seq.) did not distinguish *C. texanum* Buckl. from what later became *C. terrae-nigrae* Shinners (i.e., *Cirsium filipendulum* Engelm. and synonyms), and the synonyms given by Petrak for *C. texanum*, with the exception of *C. virginianum* var. T. & G. and *C. greenei* Petrak, properly belong under *C. terrae-nigrae*.

Series UNDULATA

13. *Cirsium undulatum* (Nutt.) Spreng. $2n = 26$

TEXAS. HILL CO.: Lake Whitney State Park, Olson & Ownbey 795, (4 plants).

This collection comes from the southeastern extremity of the range of the species. The sporophytic chromosome number is the same as reported on all previous occasions. Earlier reports for this species are as follows: Hsi (1960), Frankton & Moore (1961), Ownbey & Hsi (1963), Ownbey & Hsi (in press).

Series VIRGINIANA

14. *Cirsium virginianum* (L.) Michx. $2n = 28$

SOUTH CAROLINA. CHARLESTOWN CO.: 5.3 miles northwest of McClellanville Post Office, Olson & Ownbey 830, (2 plants).

No chromosomal irregularities were observed in the very limited sample of this species. The species is not closely allied to others in the area and its relationships to other North American thistles are obscure.

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